U.S.S.N. 10,655,972

Specification Amendments

Please replace paragraph 004 with the following rewritten paragraph:

004 One difficulty with prior art copper damascene processes is the process involving etching through an etch stop layer at a via bottom portion to form closed communication with an underlying copper region and the subsequent process of barrier layer deposition followed by copper seed layer deposition which takes place prior to filling the copper damascene, for example dual damascene, with copper according to an electro-chemical plating process. In prior art processes, a furnace baking method has been used to bake the dual damascene opening following etching through the etch stop layer to remove moisture from the IMD layer, particularly porous IMD layers and to prevent the formation of copper oxides over the underlying copper region. [[i]]In addition, ~~to removing~~ residual etching chemistries are removed to avoid corrosive attack of the copper prior to formation of a barrier layer to line the dual damascene opening.

Please replace paragraph 006 with the following rewritten

paragraph:

006 There is therefore a need in the semiconductor art for an improved method to form copper damascene features to avoid <u>or</u> prevent moisture absorption, formation of copper oxides, and corrosive chemical attack of exposed copper portions while reducing a cycle time and processing cost.

Please replace paragraph 007 with the following rewritten paragraph:

007 It is therefore an object of the invention to provide an improved method to form copper damascene features to avoid <u>or</u> prevent moisture absorption, formation of copper oxides, and corrosive chemical attack of exposed copper portions while reducing a cycle time and processing cost in addition to overcoming other deficiencies and shortcomings of the prior art.

Please replace paragraph 0017 with the following rewritten paragraph:

0017 Formed over the second etch stop layer 12B is a second IMD layer 14B, formed in a similar manner using preferred

materials as for the first IMD layer 14A. The second IMD layer 14B may be formed within the same range of thicknesses as the first IMD layer, for example having about the same or less thickness as the first IMD layer 14A. It will be appreciated the dual damascene opening as explained below may be formed in a single IMD layer e.g., IMD layer 14A including an underlying etch stop layer e.g., 12A. Formed over the second IMD layer e.g., 14B (e.g., uppermost layer in a metallization layer) is formed a bottom anti-reflectance coating (BARC) of silicon oxynitride e.g., 12C, formed at a thickness of quarter wavelength increments in a PECVD or HDP-CVD process to reduce light reflectance from a subsequent photolithographic patterning step and which additionally acts as a hard mask layer in a subsequent dual damascene opening reactive ion etch (RIE) process.

Please replace paragraph 0022 with the following rewritten paragraph:

0022 It has been found that the baking process to remove moisture from low-K porous IMD layers and the DEGAS process can advantageously be accomplished ~~at the~~ simultaneously in the presence of a hydrogen containing atmosphere. For example, porous low-K inorganic IMD layers typically strongly absorb

moisture prior to and during the etching process, heretofore making a furnace baking process necessary to adequately remove moisture to provide for effective deposition and adhesion of a subsequently deposited barrier layer. According to an aspect of the present invention, it has been found that in the presence of an H_2 containing ambient at sub-atmospheric pressures and temperatures of about 100 °C, moisture as well as adsorbed gases present from a previous etching process, for example oxygen, nitrogen, and fluorine, are effectively removed at the preferred sub-atmospheric DEGAS pressures and baking temperatures at relatively short times thereby avoiding the necessity of a separate furnace baking process, for example at atmospheric pressures, which may take several hours according to prior art processes. In addition, the H_2 containing ambient effectively reduces exposed copper surfaces to remove copper oxides. Preferably, the amount of H_2 gas present in the sub-atmospheric ambient during the DEGAS/baking process is from about 1 % to about 20%, more preferably from about 3% to about 10% with the remaining portion <u>(volume)</u> made up of an inert gas.